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AUTHOR	Christierson, Eric; Marota, Cindy; Radwan, Neveen; Wydeven, Julie
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ABSTRACT

This paper describes how San Jose State University installed adaptive and accessible computer workstations for students with disabilities. It begins by discussing factors crucial to the installation of such workstations, including the importance of understanding legal and budgetary constraints, applying standards which meet diverse disability needs, and obtaining appropriate technical help to correct hardware and software malfunctions. The adoption of a multi-year plan for access to technology to provide equal facilitation of information resources to students with disabilities is highlighted and specific features of the workstations are described, including: (1) the use of MAGic, a screen magnification program for students with visual impairments; (2) the selection of JAWS as the standard screen review application, which works with SoundBlaster 16, so a separate speech synthesizer is not necessary; (3) the use of Galileo by Robotron as a reading machine; (4) a table height design of 30 inches from the floor with a 29 inches clearing beneath the top to the depth of a least 20 inches and a minimum width of 36 inches to allow leg space for the seated individual; (5) use of ergonomic keyboard, chairs, and keyboard trays; and (6) the use of Dragon NaturallySpeaking for voice recognition. (CR)

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IMPLEMENTING ACCESSIBLE WORKSTATIONS IN A LARGE DIVERSE UNIVERSITY COMMUNITY

Eric Christierson
Adaptive Computer Specialist

Neveen Radwan
Information Technology Coordinator

Cindy Marota
Associate Director

Julie Wydeven
High Tech Center Coordinator and Trainer

Disability Resource Center
San Jose State University
One Washington Square
San Jose, CA 95192-0136

Both technology and campus climate at San Jose State University (SJSU) have reached the level where adaptive and accessible workstations can be installed in multi-use university computer environments. These workstations will meet the Americans With Disabilities Act (ADA) recommendations, and will be equipped with hardware and software to meet various disability needs. The goal for adaptive desktop applications is that they be seamless and transparent in interface. The factors crucial to installation of such workstations are: understanding legal and budgetary constraints, applying standards which meet diverse disability needs, and obtaining appropriate technical help to correct hardware and software malfunctions.

Before workstations are in place, it is important to understand the ADA requirements which will make them satisfactory under legal scrutiny. As increased technologies are introduced and become more universal in schools, the need to accommodate students with disabilities is ever prevalent. Provisions for technological adaptations are guaranteed in the same way physically disabled students are provided with access to campus programs and facilities through ramps, wheelchair lifts and elevators. Federal and state laws exist which mandate that institutions provide equal access to educational opportunities for all students. To this end, the institution must provide equal access to technological opportunities for all students. Regulations set forth under ADA and Section 504 state the responsibility of the university regarding technology access.

The Americans with Disabilities Act was a sweeping piece of civil rights legislation for people with disabilities [Sec.35.104]. The intention of the ADA is to provide equal access for people with disabilities in the areas of facilities, communication, education and technology. Most specifically, Title II of the ADA addresses the significance of providing competent communication to people with disabilities. Technology is a form of communication and must therefore be accessible to people with disabilities. Section 504 of the Federal Rehabilitation Act of 1973 (Public Law 93-112) provides that "no otherwise qualified handicapped [Sec.35.104 as defined under ADA] individual in the United States...shall, solely by reason of his handicap, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance [29 U.S.C. Sec.794, as amended by Section 111(a) of the Rehabilitation Act Amendments of 1974]. This regulation applies to all recipients of Federal financial assistance from the Department of Education. Inasmuch as public universities are recipients of Federal funding, the universities must ensure equal access to computer technology for students with disabilities.

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In order to address institutional obligations, SJSU adopted a Multi-Year Plan for Access to Technology (The Plan) to provide equal facilitation of information resources to the disabled community. The Plan takes the approach of establishing standards of access for new purchases and refreshments of technology and adopting technology for existing facilities, phased in over a five year period. As an initial step to The Plan, the University established a Presidential Directive (PD 96-02) which set a policy with guidelines providing students with disabilities access through adaptive technology. This directive defines the various roles and responsibilities of the campus community. Acting as a blue print for full access, The Plan recommends a process and structure to facilitate the task of implementing access to information literacy and laboratories for people with disabilities. The Plan works under two basic principles: adaptive technology can be standardized across the campus and maintained along with the general technology, and training and instruction can be provided under one administrative unit or department. The mission is: Provide equal facilitation for students with disabilities to the curriculum and academic resources by offering training in the use of adaptive computing at the High Technology Center, as well as offering access in every PC lab through adapted PCs.

In addition to legal implications, it is essential to perceive how an adaptive workstation budget is initially arrived at and how it is kept alive in the budget process of a large, public university. In today's era of "tight budgets," the university must make a commitment to work as one cohesive unit in the delivery of adaptive technology to the disabled community. Instrumentally, efforts from the senior management to the lab technician to the level of the faculty and lab instructors are included in the implementation of The Plan. At San Jose State University, collaborative efforts from the Chief Information Officer (CIO), the Director of the Disability Resource Center (DRC) and the President's Office, afforded an ADA budget expressively for the implementation and maintenance of The Plan. The ADA budget allows the university to comply with their legal obligation while assisting departments when necessary, with refreshment or renovation of their labs. The estimated budget to achieve access to technology is $400,000, to be phased in over a five-year period, with an annual budget of $71,000. The actual costs to achieve access to technology may be lower if adaptations can be achieved as PC labs are renovated or replaced. However, they may also be higher if the numbers of PC labs needing to be adapted are more than estimated at the time of this writing, or if unforeseen technical problems arise. In order to achieve this end, The Plan uses the approach of the High Technology Center (HTC) as the hub for all instruction and training, and the PC labs as the spokes connecting the HTC to curricula activities. This model limits staff involvement in PC labs to maintenance, and thereby reduces cost. All departments using assistive technology should maintain a budget for changes in versions and hardware requirements. As with all other computer software, changes come very frequently as different requirements must be met. This makes it necessary to keep current with the different versions. Having a budget available for such upgrades will minimize the chances of falling out of ADA compliance and increasing the risk of possible legal problems.

Much of our computer access experience in the Disability Resource Center (DRC) at SJSU is centered on students with vision, physical and learning disabilities, and we have developed standards which meet the adaptive computer access needs of these students. Establishing standards for access stations for students visual and physical disabilities is problematic but necessary for three reasons: standardization promotes independence; standardization provides a consistent platform for

continuous training; and, standardization promotes lower costs over extended periods. With an initial accessible station in each computer lab, disabled students have an opportunity to work and associate with persons in their chosen academic field. Learning applications such as JAWS, MAGic, Half-QWERTY, or configuring sticky keys and filter keys takes time, practice, and experience. If applications appear on each access station, then the student directly perceives the training provided by the DRC as useful and applicable. Creating standards for access stations will promote cost efficiency because software applications and hardware can be purchased in multiple units for many users rather than for one user with an individual need.

Keeping in mind the primary objective is independence and the secondary goals include flexibility and cost, it is important to discuss specific software and hardware selected to provide access for the visually impaired and the physically disabled. At SJSU, the DRC chose MAGic as the screen magnification program for students with visual impairments. MAGic is easy to configure and is proven to be stable and relatively less expensive. The acquisition of MAGic by Henter-Joyce, the screen reader vendor, also influenced this decision, believing that magnification and the screen reader will soon be combined into a single program. The DRC has found a compatibility problem with specific video cards. The solution lies in purchasing the compatible video card.

Stability, ease of installation and configuration, compatibility, and a reasonably short learning curve were the reasons for selecting JAWS as the standard screen review application. The Windows 95 operating system provides a great working environment for JAWS: the program reads the screen in most Windows' applications, and it is compatible with both Netscape and Microsoft Internet Explorer. JAWS is accessible from any application: a student can change voice, rate, pitch, punctuation, and volume from a single menu and JAWS works with SoundBlaster 16, so a separate speech synthesizer is not necessary. If the student knows the keyboard, he or she will be able to navigate in applications and read pages of text. With several additional hours of training, he or she will be able to edit, spell check, and format papers.

The DRC selected Galileo by Robotron as a reading machine. The Galileo is a stand-alone scanner capable of reading text or scanning images. Galileo is equipped with its own hard drive and floppy drive, thus allowing a scanned document to be saved to the hard drive and then saved to a floppy disk. Once the file is saved, it can then be accessed at any time for rereading. The keyboard is attached to the machine, is simple to operate, and is accessible to students in wheelchairs. Braille printer and Braille input devices should be included in standards for larger computer labs. The DRC chose the INDEX, Basic-D Printer with the following necessary features: tractor feed paper, double-sided Braille, and a speech guided user interface.

For physical disabilities and repetitive stress injuries, the DRC has set standards for The Plan achieving certain universal accommodations. A table height of 30 inches from the floor with a 29 inch clearance beneath the top to the depth of at least 20 inches and a minimum width of 36 inches to allow leg space for the seated individual. Utility and equipment controls must be within easy reach. For wheel chair access, the aisle must have a width sufficient to maneuver the wheel chair; recommended width is set at a radius of five feet. Ergonomic keyboards, chairs, and keyboard trays, which adjust to each student's needs, are fundamental. The DRC standards also recommend the use of sticky keys and filter key configurations for particular students. These software applications are included in Windows 95. For students who type with one hand, DRC suggests the

program Half-QWERTY, by the Matias Corporation. This program is simple in concept and takes relatively little time to learn if the student is familiar with the keyboard.

Voice recognition technology is extremely effective for students with limited range of motion. The DRC trains using Dragon NaturallySpeaking which has a multi-user version. Voice recognition software is also helpful for students with learning disabilities in the area of expressive language. One essential skill for successful voice input of text is the ability to visually scan or to use a text reader or tutor to detect usage errors.

At SJSU, the DRC trains using Microsoft Office '97 because it is a campus norm. In terms of writing development standards, a visual idea development tool like Inspiration is cost-effective and beneficial. Word-prediction software works seamlessly with most word-processing applications and is practical for students with moderate to severe language deficits. Currently the DRC is training students in the High Tech Center on TextHelp. A variety of students can utilize word prediction with speech capability. Shared campus-wide licensing with upgrade options for each of the above applications is cost-effective in long range planning.

Given a basic knowledge of the legal and budgetary issues and the needs of students with vision, physical and learning disabilities, a fourth vital part to successful installation of adaptive and accessible workstations is the contribution of knowledgeable technical personnel. Technological aspects must be considered when attempting to get different assistive technologies to work together. The expense involved in implementing these technologies is in no way minimal. The price of the software alone starts in the thousands without considering that each individual machine requires a separate license. Adaptive software packages tend to be extremely resource intense. To run the latest versions of the programs at average speed and reliability, it is essential to utilize a high-end computer system.

To set standards for SJSU, the DRC recommends specific vendors for our assistive software. The vendors were chosen based on two criteria: prior testing by HTCs and availability for Windows 95 and Windows NT platforms. As technology advances, more and more offices and computer labs are migrating to Windows NT. In the interest of standardization, it is imperative that only products available to both sets of users be chosen. This narrows choices down considerably. NT is a very high-end operating system that has strict restrictions on programs that directly access the computer hardware. Assistive software is highly dependent on the individual hardware components. For example, screen magnification software utilizes video card drivers to enlarge the screen, and screen reader software accesses the sound card to vocalize what is presented on screen. Traditionally, the easiest way for software developers to get software to use hardware components is to have the software physically access the drivers for the hardware. However, for various reasons, NT will not allow such access, which makes the software unable to run on NT machines. Most companies have not yet been able to invest the extra expense required in providing software versions that will run on NT machines. One vendor with such products is Henter-Joyce, which makes MAGic screen magnification software and JAWS screen reader. Considering their solid reputation, it was beneficial that one vendor made both products; this created less chance for future conflicts. For voice recognition, Dragon Systems DragonDictate and/or NaturallySpeaking were chosen. Dragon Systems has been the industry leader in voice recognition software, which made it instantly

appealing. DragonDictate is used for voice command navigation and NaturallySpeaking for dictation.

Adaptive products are not always compatible with all computer components. More often than not, assistive software is marketed after being developed and tested on specific brands of hardware. Conflicts are found by users who are unaware of the lack of standardization in computer components. For example, in the renovation of the HTC, the DRC ordered Pentium 200 MHz machines with very high-end video and sound capabilities. Having top of the line equipment does not necessarily translate into a successful assistive technology lab. After receiving, setting up the computer systems and installing the software, it was discovered that MAGic was not compatible with the type of video card installed in the computers. The technical support at Henter-Joyce confirmed that MAGic was, in fact, not compatible with all video cards. It became necessary to replace existing cards with cards approved by Henter-Joyce. Henter-Joyce maintains an ongoing list of compatible equipment with their products on their web site.

Henter-Joyce is also the vendor for JAWS, the screen reader chosen by the DRC. Again, the DRC was faced with the situation of incompatibility between the program and the standard hardware. JAWS relies on the sound capabilities of the computer; however, it was designed to work with either a traditional voice synthesizer or specifically a SoundBlaster sound card with Text Assist software. Although most sound cards on the market are SoundBlaster compatible, the Text Assist software only works with original SoundBlaster cards made by Creative Labs. With the most recent release of JAWS (version 3.0), Henter-Joyce has begun selling Access 32 software as an option which allows any sound card to emulate a voice synthesizer allowing it to work with JAWS. The choice then became whether to purchase the Access 32 software or replace the existing sound cards with SoundBlaster cards. The DRC chose to replace the sound cards as opposed to using the existing cards. The DRC had much experience with using SoundBlaster cards with JAWS and were confident in their compatibility and ease of implementation. The purchase of new sound cards was more cost-effective which is always imperative on a university campus. After installing both MAGic and JAWS, it became apparent that it is generally a good idea to find out what hardware devices are compatible with the programs that will be used before computers are purchased. This will enable departments to either order computers with the specific brands, or if not possible, order computers without the components and purchase them separately. Some computer vendors do not allow buyers to customize individual components. Customization would definitely become a factor in choosing the vendor to provide the systems.

The final piece of software to install was the voice recognition package, Dragon NaturallySpeaking. This program is intended to work with the program DragonDictate allowing a person complete hands free use of the computer. NaturallySpeaking is extremely resource intense. It requires a minimum of 32 MB of RAM as well as a Pentium 133 MHz processor. These requirements are much above what the majority of users, particularly university campuses, are using. Based on the DRC experience, the minimum recommended would be at least 64 MB of RAM with a 200 MHz or faster processor. In addition, when it was first released, NaturallySpeaking was not available in a multi-user package. For the DRC lab purposes this presented problems because it became necessary to install multiple copies of the program to accommodate additional users. This not only became a waste of much needed hard drive space, it also created many conflicts within the different copies.

Overall, there are common issues to be addressed with any implementation of assistive technologies. It is apparent that assistive software will continue to be extremely demanding on system resources. When planning to implement such technologies, it is imperative that computers be purchased with the fastest processor and the greatest amount of RAM that can be afforded. This will minimize the chances of computers becoming obsolete as newer versions are released. Another factor to be considered is the operating system. Although the software purchased was chosen because versions were available for Windows NT, it is very important that the pros and cons be considered when implementing NT in an assistive technology lab. NT versions are still in general considerably more expensive than their Windows 95 counterparts, and the difference can range up to four times the price of Windows 95.

It is now possible to have effective adaptive and accessible computer workstations in multi-use university computer labs. The challenges and solutions lie in the areas of law, budget, disability needs and technical innovation and application. To access the DRC standards pages, visit us at our Web site: www.drc.sjsu.edu.